



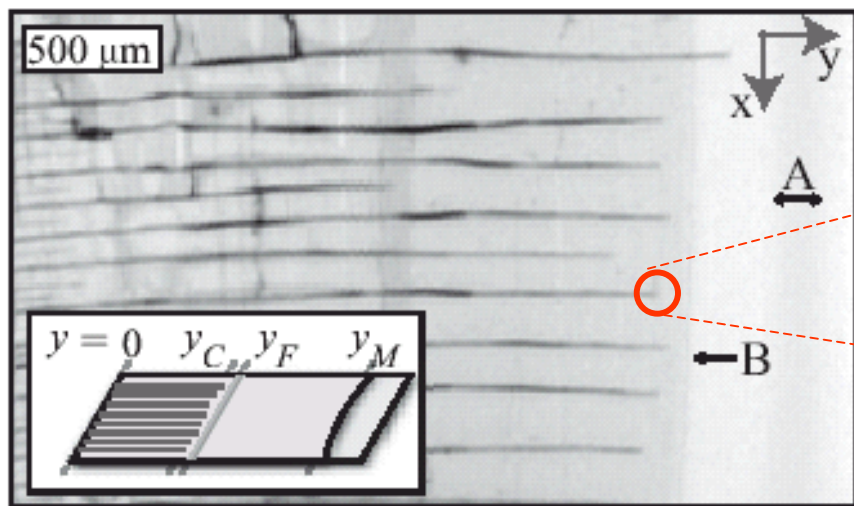
Materials Research Science & Engineering Center

David A. Weitz, Director; Harvard University; DMR-0213805

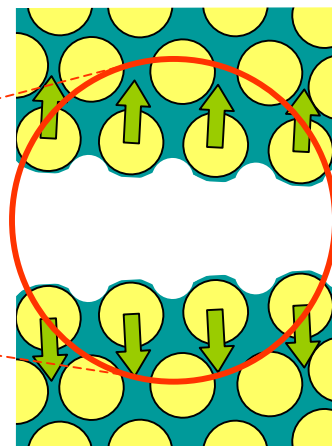
Research Highlight – Fracture in Drying Nanoparticle Suspensions

Drying is a crucial step in the processing of a variety of materials, from the common coat of paint to emerging photonic band-gap structures. As the suspending fluid evaporates, fracture, delamination, and buckling can ruin the material. Profs. **Weitz**, **Hutchinson** and **Xie** have been exploring drying nanoparticle suspensions, which are particularly prone to fracture. In the nanoparticle regime, drying stresses, originating from the affinity of the fluid for suspended particles, can exceed 1000 times

atmospheric pressure. Furthermore, the fluid immersing nanoparticles can behave strangely. Since the gaps between tightly packed nanoparticles are only a few molecules across, fluid molecules can be arrested by strong short-range interactions with the nanoparticles. Recently **MRSEC REU** students have demonstrated the importance of these molecular-scale interactions on the macroscopic dynamics of drying nanoparticle suspensions (to appear in *Physical Review Letters*).



Cracks invade a drying film of silica nanoparticles.



Drying stresses, up to 1000 times atmospheric pressures, can fracture this fluid-solid composite material.



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Educational Programs

Our **educational objective** is to provide an exciting research environment and opportunities for **career development for young scientists**. Many students get their first exposure to research in our Research Experience for Undergraduates (**REU**) program. The interdisciplinary nature of the research in the Center provides a wonderful example of how materials scientists, physicists, biologists, chemists and engineers work side-by-side to forge new discoveries.

Strong efforts to **recruit** talented **female** and **minority students** have been made by our Center faculty members during campus visits and through collaborations with faculty at Historically Black Colleges and Universities (HBCUs). In 2003, 48% of our REU participants were members of under-represented groups and 58% were female. In addition to mentoring the research projects, special activities have been initiated to encourage students recruited from these institutions to pursue graduate study (lower right) and ultimately form a pool of well-prepared, enthusiastic and self-motivated future scientists and engineers.



Chris Holland (REU, Morehouse College, biology major), Valerie Bennett (Asst. Prof. of Physics, Morehouse College) and Prof. Howard Stone (Chem. Eng.) discuss Chris's REU project on microfluidics in Prof. George Whitesides' chemistry laboratory.



David Evans (Senior Admissions Officer, Harvard College) addresses REU students, faculty and mentors at a luncheon sponsored by the Harvard Foundation for Intercultural Relations early in the summer to welcome and support the students.